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Published in:
British Journal of Criminology, delinquency and deviant social behavior

DOI:
10.1093/bjc/azt052

Publication date:
2014

Document Version
Early version, also known as pre-print

doi:10.1093/bjc/azt052 BRIT. J. CRIMINOL

REVISITING THE GUN OWNERSHIP AND VIOLENCE LINK

A Multilevel Analysis of Victimization Survey Data

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The link between gun ownership victimization by violent crime remains one of the most contested issues in criminology. Some authors claim that high gun availability facilitates serious violence. Others claim that gun ownership prevents crime. This article revisits these issues using individual and aggregate data on gun ownership and victimization from the International Crime Victims Survey (ICVS). Analysis at country level shows that the level of handgun ownership is positively related to serious violence but not for less serious violent crimes. Multilevel analyses on the data from 26 developed countries show that owners of a handgun show increased risk for victimization by violent crime. High ownership levels, however, seem to diminish the victimization level for the less serious violent crimes for the non-owners.

Keywords: crime, violent crime, firearm ownership, international comparison, multilevel analysis

Background

One of the ongoing debates in evidence-based crime prevention concerns the possible causal relationship between gun ownership and violent crime. On one side of the debate stand those claiming that the availability of a firearm acts as a facilitator of the commission of serious crimes of violence by providing potential assaulters with the opportunity to attack others with an especially dangerous instrument. This position in the debate is theoretically grounded in situational crime prevention theory (Felson and Clarke 1998). The notion of guns facilitating violence is the key assumption behind the strict regulation of gun ownership in most European countries and behind government programmes seeking to decrease gun availability in a variety of countries including Brazil, Canada Columbia, Mexico, South Africa and parts of the United States. It also lies behind the global campaigns against illicit production and trafficking in small firearms (Small Arms Survey 2009). On the other side of the debate stand those who deny the facilitating impact of gun availability. Some authors claim that the gun ownership of potential victims acts as a preventive or protective measure by deterring would-be attackers. The latter position has been elaborated by Lott (2000).

Over the years, many empirical studies have been conducted on the gun ownership–violence link. Research on this relationship is methodologically difficult, for several reasons. First, a dearth of reliable data exists on both gun ownership and on violence between civilians. Especially in countries where gun ownership is illegal, as in most countries in Western Europe and Asia, official ownership statistics possess ample 'dark numbers'. Official statistics on gun ownership cannot therefore be reliably used for

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cross-country comparisons. The same can be said of official statistics on the numbers of crimes of violence committed. Numbers of violent crimes recorded by the police are known to be heavily influenced by different reporting patterns and recording practices. This explains why countries with efficient police forces such as Sweden and Denmark invariably come at the top of the list of recorded crimes of violence per capita and many developing countries at the bottom (Van Dijk 2008).

A second constraint of studies on the gun–violence link—partly related to the dearth of reliable data on violent crime—is that data used in analyses often come from relatively small and possibly unrepresentative populations. Many studies have been conducted on data from the United States only. Other studies look at the relationships between firearm ownership and homicide rates (which are supposed to be more comparable than those on other violent crime). Statistics on homicide are mainly from developed countries. The use of such restricted datasets obviously limits the generalizability of the results. The dynamics of guns and violence in the United States might not be representative for the rest of the world. Findings on relationships between guns and homicide in small samples of mainly developed countries might not apply to other types of violent crime or to other regions.

A third factor complicating this line of research is the need to distinguish between relationships at the level of countries with those at the level of individuals. Official statistics on gun ownership and violent crime are typically available at the aggregate level only. However, from statistical relationships at the level of countries, no inferences can be made about relationships at the micro level of individuals.

The conduct of victimization surveys among the general public has yielded data sets which can be used to examine the gun–violence link. This is true for major national victimization surveys such as the NCVS and the BCS and it is especially true for the first internationally conducted standardized victimization survey, the International Crime Victims Survey (ICVS). The ICVS has been carried out once or more in over 80 countries in six global sweeps between 1989 and 2010 (Van Dijk *et al.* 2008; Van Dijk 2012). The ICVS data set has three characteristics facilitating the examination of the possible links between gun ownership and violence. It, first, contains data on victimization by a range of different types of violence, including on gun-related crimes. It, second, contains data on self-reported ownership of firearms and handguns. And, third, its data allow an analysis of links between gun ownership and victimization by violence at both individual and aggregate (country or city) levels. Over the years, the ICVS data sets have been used to examine the gun–violence link from an international perspective (Killias 1993; van Kesteren 2000; Killias *et al.* 2001; Altheimer 2008; Van Dijk 2008). Using gun ownership data from the ICVS 1990 and homicide and suicide data from the WHO, Killias (1993) found a significant positive correlation between gun ownership and rates of homicide and suicide at the macro level of countries. Analyses of data from subsequent rounds of the ICVS involving more countries concerning gun ownership and victimization by various types of violent crime confirmed part of the previous findings of Killias *et al.* (2001). The analysis revealed strong correlations between rates of gun ownership and rates of suicide with a gun, gun-related homicide involving female victims and gun-related assaults. The results were negative for the categories male homicide, common assault and robbery.

In a review of the international literature, Hepburn and Hemenway (2004) conclude that the international evidence points at a positive relationship between gun availability

and levels of homicide per country. The guns–homicide link is further corroborated by comparisons between American and Canadian cities (Sloan *et al.* 1988). The research team of the Small Arms Survey have shown globally that more women are killed by violence where there are more guns around (Small Arms Survey 2004).

The federal structure of the United States allows considerable variation in gun laws, thereby allowing state-by-state comparisons of levels of gun availability and types of violence. Across US regions, more homicides are committed where there are more guns, controlling for other relevant factors (Miller *et al.* 2004). This result was confirmed by Felson and Pare (2010). In earlier research, gun ownership was found to be related to gun-related robberies (Cook 1987). Felson and Pare (2010) also found that gun availability per state is unrelated to rates of common assault. The divergence between comparatively high levels of homicide and comparatively low rates of common assaults is especially striking in the southern states. In the view of the authors, the near universal presence of firearms in the south may discourage common violence because fear of armed adversaries may lead potential attackers to avoid provocation. The latter result is in line with the negative results found by Killias *et al.* (2001) concerning possible links between gun ownership and levels of common assault at the international level. Using data from subsequent ICVS rounds, Van Dijk (2008) confirmed the absence of a relationship between gun ownership and levels of threats and assaults at the level of countries.

One of the most widely cited publications in the American debate on this issue is from the economist Lott (2000). The author argues on the basis of an analysis of US data at the county level that liberal gun laws permitting the carrying of concealed weapons led to less crime by deterring would-be offenders. A review of available literature (Wellford *et al.* 2004) rejects Lott's claim that a negative gun–crime link is empirically in evidence among counties in the United States. His results are also refuted by a time-series analysis of American data on gun ownership and gun-related homicides (Duggan 2001). A recent study by Fleegler *et al.* (2013) on data from 50 US states shows that states with stronger gun laws have fewer gun-related fatalities.

The results of the macro-level studies on the gun–violence link have produced mixed results. The link between gun availability and homicides has been firmly established for homicides against women and for gun-related homicides. International evidence on the link between guns and total homicide is less conclusive. American cross-sectional and time-series studies confirm the link but international comparisons show different results. These differences might be caused by the use of different samples of countries. Studies using data from North America or from developing countries seem to confirm the link, while studies of data from mainly European nations are less conclusive. A possible explanation is that variations in gun ownership and homicide rates among European countries are not sufficiently large to establish clear relationships. When data from the United States and developing countries are included, the variation in both variables increases and relationships are in evidence. ICVS-based studies have confirmed links between gun ownership and gun-related assaults and robberies but not between gun ownership and rates of assault and/or robbery in either the United States or Europe. By and large, the results suggest that the availability of guns facilitates the commission of more serious types of violence, especially gun-related violence but not necessarily the overall level of violent crime in a country. These results are broadly in line with situational crime prevention theory stating that levels of crimes are determined by available opportunities.

Fewer studies have been conducted on the gun–violence link relationship at the individual level. According to American results, defensive actions of victims have a significant positive effect on the outcome (Kleck and Gertz 1995). Whether these effects outweigh possible negative effects is unclear. A study by Kellerman *et al.* (1993) suggests that the presence of a gun in the home makes it 2.7 times more likely that a family member will become victim of a homicide. Using data from cities in developing countries taken from earlier rounds of the ICVS, Altheimer (2008) carried out a multilevel analysis. He found that gun availability as a contextual variable is related to the risks of victimization by gun-related assaults and robberies (but not to other assaults and robberies). In addition, owners of firearms are more likely to be victimized by assaults, both those involving guns and those without. He also found insignificant, positive relationships between individual gun ownership and victimization by robbery, with or without the use of guns. These findings support the notion that gun ownership acts as a risk-enhancing rather than as a protective factor. Similar results were found in an analysis of the data of a national victimization survey in Venezuela (Gabaldón *et al.* 2011).

A common feature of the above-mentioned studies is that they are based on cross-sectional analyses of retrospective data on violent crime taken from police administrations or victimization surveys. Although the results consistently confirm a correlational link between gun availability and serious violence controlling for possible external factors, causality cannot be inferred with certainty. The possibility that gun availability acts as a proxy for other contextual or individual characteristics can never be fully excluded. In this respect, our own results, presented hereunder, form no exception. In order to establish causal relations, studies need to be done in an experimental setting. Straightforward experiments on the impact of gun availability on the occurrence of serious violence are ruled out for ethical reasons. Experimental designs to test the gun–violence link will, if at all feasible, always suffer from limited external validity. Considering the impossibility of straightforward experimental research on this issue, a revisiting of the gun–violence link using new cross-sectional data seems warranted in spite of their inherent limitations concerning causal inference.

Subject Matter and Outline

This article revisits the gun ownership–violence link, mainly using data from the fifth sweep of the ICVS, conducted in 2004 and 2005. In this sweep, the survey was carried out in 31 nations, among randomly selected samples of the public of 2,000 persons per country (van Kesteren 2007; Van Dijk *et al.* 2008). Data are available from 26 industrialized countries in the world, including Japan, as well as from a number of Eastern European countries (four) and Mexico. The ICVS provides information on victimization by ten common crimes including various types of contact crimes involving or not involving guns. Also available is self-reported information on ownership of different types of firearms in the household. This information is, as said, available at the level both of individual respondents and of countries. In order to broaden the variation in key variables, some analyses of relationships between gun ownership and homicides were carried out using data sets from older ICVS sweeps covering a larger number of countries.

We will first present some descriptive data on the levels and nature of gun ownership per country based on the ICVS 2005. Next, we will explore the gun ownership–violence link presenting basic bivariate statistics at the country level. This is followed by an

analysis of the gun–violence link at the level of individuals. The key question is whether ownership of a gun acts as a risk-enhancing factor for victimization by contact crimes or not, controlling for known risk factors such as age, and the number of outdoor leisure activities (Hindelang *et al.* 1978; Van Dijk and Steinmetz 1980; Felson 2002). In a final section, we will discuss the results of a multilevel analysis integrating the previous analyses at the macro and micro levels. The results will show whether and to what extent the effects of firearm ownership on the risk of individuals to be victimized are determined by contextual variables. In a concluding paragraph, we will discuss how the findings compare with results of previous studies and which general conclusions can be drawn. The article finishes with some suggestions for further research.

Description of the Data on Firearms and Victimization

Firearms, guns and reasons for ownership

The ICVS asks respondents whether a firearm is present in the house and, if so, what type of firearm. The questionnaire distinguishes between long guns (rifles and shotguns) and handguns. Those who own any firearms are asked the reasons for ownership. The results are given in Figure 1. As can be seen in the figure, the United States, Switzerland, Finland, Norway and Iceland have the largest number of rifles and shotguns, directly followed by Sweden, Greece and New Zealand. Of this set of countries, only the United States and Switzerland also belong to the group of countries with the highest number of handguns. Japan, Australia, England and Wales, Spain, New Zealand, Scotland, Poland and Ireland know ownership rates for handguns below 1 per cent. Reliability intervals have been indicated in the graph.

The reliability intervals are relatively large for countries with low ownership levels. It is therefore difficult to reliably distinguish countries with 'average' and 'low' ownership rates. Overall, sufficient variation in both ownership rates exists to warrant further analysis of possible links with levels of violence. The question on firearm ownership has been included in the 1996 round of the ICVS for the first time and was retained in the 2000 and 2005 sweeps. Since participation varied across the rounds, trend data since 1996 are available for only a very limited number of countries. In most of these countries, ownership levels have remained stable. A noticeable exception is the United States, where ownership rates seem to have somewhat declined (Van Dijk *et al.* 2008). The difference in ownership of handguns and long guns reflects the contents of national gun control laws.

Those owning firearms were asked for the reasons for their ownership. Table 1 shows results. Hunting is the main reason for owning a firearm in all countries. This typically applies to the ownership of long guns. For handguns, hunting is the second most frequently mentioned reason after sports. Quite a number of households possess a gun for no particular reason (the weapon has always been in the family or is part of a collection). Handguns are also owned for reasons of protection or prevention; this is the case for 23 per cent of the handgun owners. The fifth most common reason is that the guns are owned because someone in the household carries out police or security work or because it is an army gun. No data are available for Switzerland, but previous research indicates that the most important reasons for ownership in this country are hunting and mandatory ownership of a handgun among army reservists (Van Dijk *et al.*

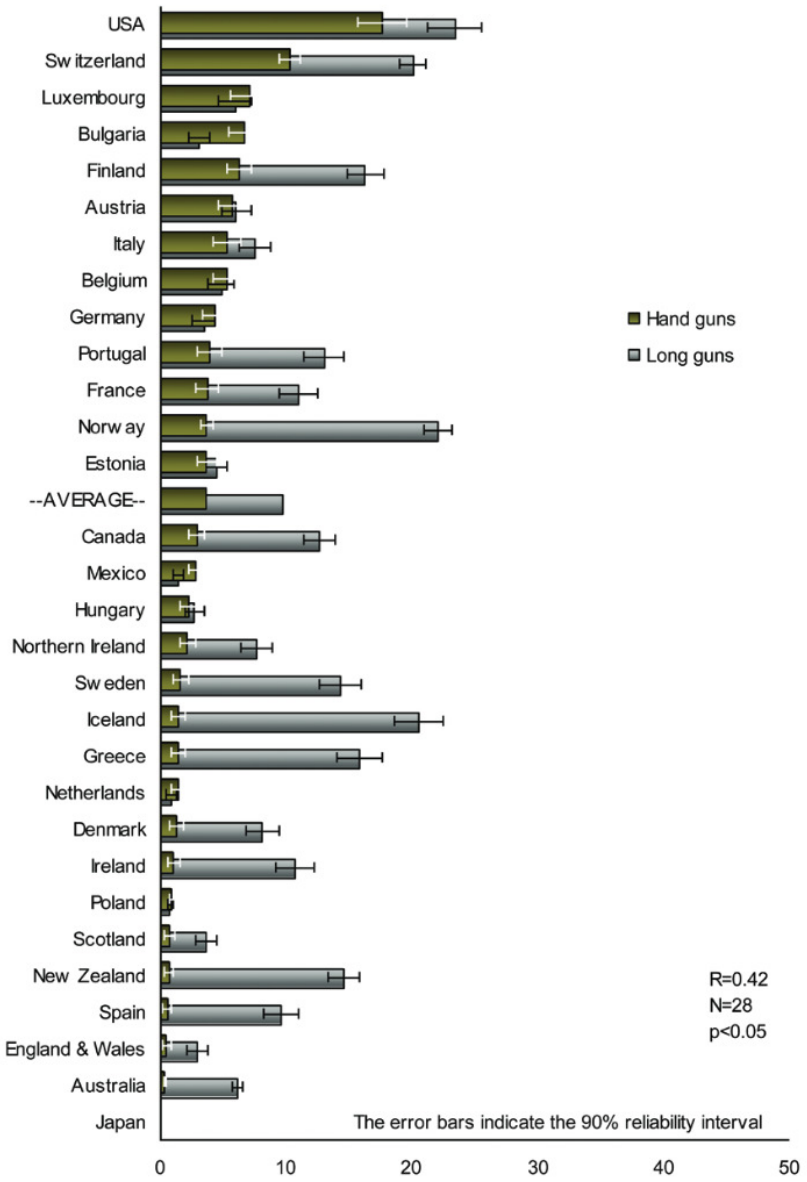

FIG. 1 Ownership levels for long guns and handguns—percentage of households owning at least one.
Data from the 2004/05 ICVS.

TABLE 1 *Reasons for owning a firearm, broken down by type of firearm—percentage of firearm owners*

	Handguns	Long guns
Hunting	25	66
Sports	28	18
Has always been in the family	12	11
Prevention and protection	23	7
Collection	8	5
Army/police	16	3
Don't know	6	3
Refusal	1	1
Total*	119	114

* More than one reason can apply; therefore, percentages add up to more than 100%.
Data from the 2004/05 ICVS (industrialized countries; data for Switzerland are not available).

1990). There are some noticeable cross-country differences in the reasons for ownership. A pronounced difference was found between the reasons of owners in the United States and those elsewhere. Overall, prevention and protection are a more prominent reason for owning a firearm in the United States than anywhere else. This difference is fully explained by the relatively large number of handguns.

The correlation between ownership rates of the two types of firearms is modest ($r = 0.42$, $n = 28$) but statistically significant. The 28 countries can be grouped according to whether they have above or below-average ownership levels for the two types of guns. Results are shown in Table 2.

Victimization by contact crimes

Contact crimes are defined as crimes whereby victim and offender are in direct contact with each other during the commission of the offence. As said, the ICVS distinguishes three main types of contact crimes: robbery, sexual offences and assaults and threats. Figure 2 shows the one-year prevalence rates for these three types of contact crimes from the 2005 ICVS (data available from 29 countries). Also shown are one-year victimization rates for six types of non-contact property crimes (burglary, three types of

TABLE 2 *Typology of countries based on below-average, average or above-average ownership levels of handguns and long guns*

	Ownership level of long guns		
	Low (<5%)	Average (>5%, <15%)	High (>15%)
Ownership level of handguns			
Low (<1%)	England and Wales, *Japan*, *Poland*, Scotland	Australia, Ireland, New Zealand, Spain	
Average (>1%, <5%)	*Estonia*, Germany, Hungary, *Mexico*, The Netherlands	Canada, Denmark, France, Northern Ireland, Portugal, Sweden	Greece, Iceland, Norway
High (>5%)	Belgium, Bulgaria	Austria, Italy, Luxembourg	Switzerland, USA, Finland

Italic: Because of missing values for other variables, data from these countries could not be used in multivariate analyses. Data from the 2004/05 ICVS.

vehicle theft, theft from a car and other personal theft). Also included in the graph are five-years victimization rates for contact crimes in which a firearm was involved.[1]

Countries with the highest victimization rates for contact crimes include New Zealand, England and Wales, Iceland, Ireland and Northern Ireland. Above-average victimization rates are found in Denmark, Estonia, Netherlands, Sweden and the United States. Bulgaria, Luxembourg, France, Spain, Finland, Austria and Greece have figures below average. Lowest victimization rates are found in Japan, Italy, Portugal and Hungary. Figure 2 indicates the 90 per cent reliability intervals for the victimization figures for the one-year prevalence rates. Differences between the countries are not always statistically significant. The correlation between the two categories of crimes, contact crimes and property crimes is moderately strong, at 0.64 ($p < 0.05$). Of the countries with high victimization rates for contact crimes, New Zealand and England and Wales are also in the group of countries with the highest rates of property crimes. Japan, Italy and Portugal have relatively more property crimes than contact crimes; they have victimization rates for property crimes slightly below average, but very low rates for contact crimes. Also included in the graph are the five-year victimization levels for contact crimes whereby a firearm was involved. The differences between the countries are in most cases not statistically significant due to the low percentages, but Mexico, Northern Ireland and the United States stand out with the highest rates.

Correlations between Firearm Ownership and Victimization at Country Level

As a first step in the analysis of the guns–violence link, we have looked at the correlations between firearm ownership (handguns and long guns separately) and victimization rates for contact crimes with the use of firearms, other contact crimes and property crimes. In order to maximize the numbers of countries included, we have combined data from the 1996, 2000 and 2005 rounds, always using the latest data available per country ($n = 50$). Since gun-related crimes are rare in most countries, five-year victimization rates are used for these types of crime. Results are given in Table 3.

The results show that ownership rates for handguns are positively related to victimization rates for contact crimes involving firearms, including assaults and threats involving a gun. A positive but statistically insignificant relation is found between handgun ownership and victimization by contact crimes generally. This finding confirms the earlier result that rates of victimization by assaults and threats are unrelated to handgun ownership (Van Dijk 2008). There is no correlation at a national level between handgun ownership and victimization by property crime. Neither is there a relationship between long-gun ownership and any type of victimization. These results show that analyses of the gun–violence link at the macro level should focus on handgun ownership.

The ICVS produces no data on victimization by homicide. To replicate previous studies of the gun ownership–homicide link, data have been used from a newly developed dataset of the United Nations distinguishing between firearm-related and non-firearm-related homicides (UNODC 2009) as well as from similar older UNODC data sets. The homicide data relate to 2005 or 2006 or, when these were missing, from older years. In the analyses, we have looked at overall homicide rates, rates of homicides involving firearms and the proportion of all homicides involving firearms. Firearms ownership data are from the

[1] Five-year prevalence rates are shown because of the very low one-year victimization rates for these types of crimes.

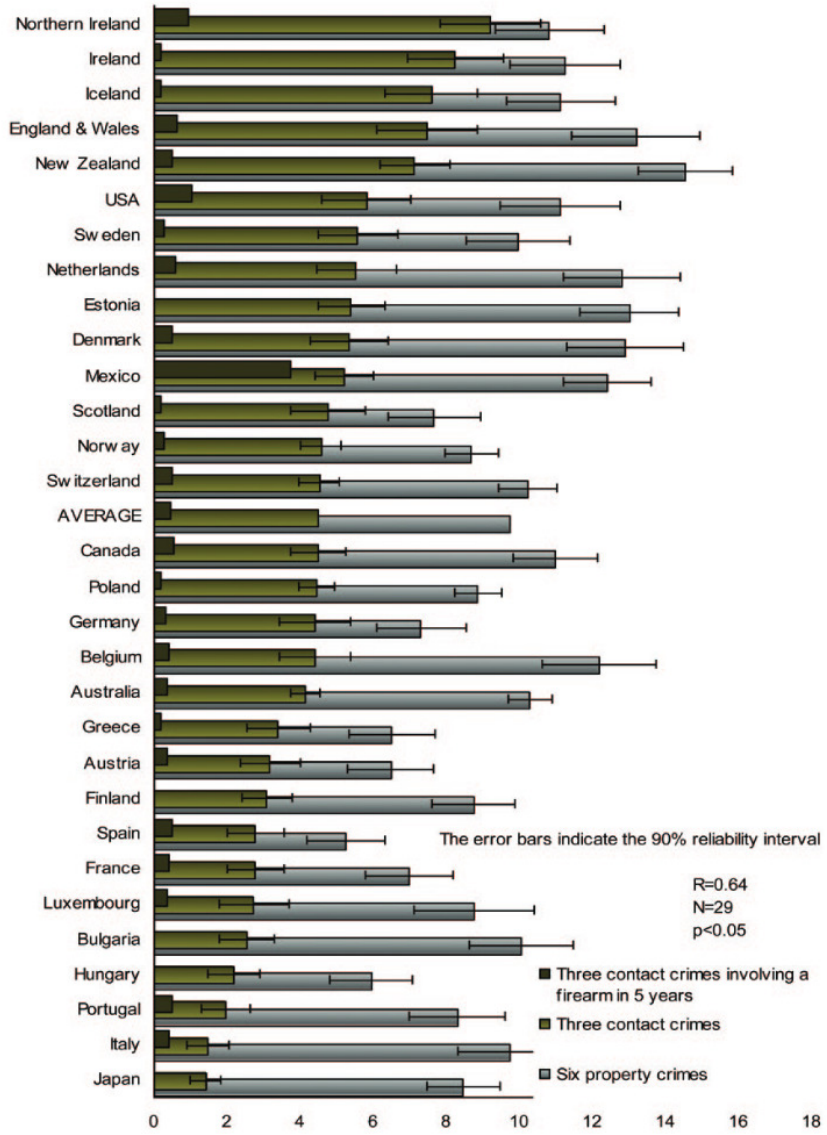

FIG. 2 One year prevalence victimization rates for six property crimes and three contact crimes. Added are the five year prevalence rates for contact crimes involving a firearm (the percentages for gun related contact crimes are not high enough to calculate 90 per cent error margins). Data from the 2004/05 ICVS.

TABLE 3 *Correlations between firearm-ownership levels and victimization levels for different types of crime (one-year and five-year prevalence rates)*

	Ownership level of firearms	
	Handguns	Long guns
Victimization by six property crimes: one-year prevalence rates	–0.03 N = 50 (p > 0.05)	–0.07 N = 50 (p > 0.05)
Victimization by three contact crimes: one-year prevalence rates	0.21 N = 50 (p > 0.05)	0.07 N = 50 (p > 0.05)
Victimization by three types of gun-related contact crimes: Five-year prevalence rates	0.57 N = 47 (p < 0.05)	–0.19 N = 47 (p > 0.05)

Data from the latest available ICVS (1996–2000 or 2005/06).

ICVS 2005 or from older sweeps if no recent data were available. Altogether, data were collected from 50 countries. Results of the correlation analysis are shown in Table 4.

The results show significant positive relationships between handgun ownership and the three measures of homicide. The correlations are dependent on the inclusion of the United States and some non-Western countries (notably Brazil, Colombia and South Africa). As was the case with victimization by contact crimes, ownership of long guns shows no significant correlations with any type of homicide. The weak relationship between long guns and the proportion of homicides committed by firearms is likely to be caused by the impact of handgun ownership, since national rates of handgun ownership are, as discussed, correlated with ownership of long guns.

Individual-Level Analysis

The next question to be addressed is whether for individuals ownership of a firearm increases or decreases the risk of becoming a victim of a crime. As explained, information is available on the question of whether or not a firearm was in possession of the respondent's household. An important category of contextual information used in this analysis is whether the respondent lives in a country with low, average or high ownership

TABLE 4 *Correlation between firearm-ownership (handguns and long guns) and homicide rates around 2005 (overall homicide, gun-related homicide and proportion of homicides committed with a firearm)*

Homicide victims per 100,000 population	Ownership level of firearms	
	Handguns	Long guns
Homicide[1]	0.39 N = 50 (p < 0.05)	–0.23 N = 50 (p > 0.05)
Gun-related homicide[1]	0.37 N = 50 (p < 0.05)	–0.08 N = 50 (p > 0.05)
Proportion of homicides, committed with a firearm[1]	0.55 N = 50 (p < 0.05)	0.28 N = 50 (p < 0.05)

[1] Source: UNODC, 2009. Homicide rates are from 2005 or 2006. For eight countries, older data have been used and/or we had to revert to other sources. In case homicide rates for 2004/05 were available but not the gun-related rates, we applied the proportion of homicides which were committed with a firearm from an earlier year. Tables with data and sources are available on request. Sources: ICVS 2000 and 2004/05 and UNODC, 2009.

rates of long guns or handguns, respectively. The analysis is, of necessity, restricted to victimization by non-lethal contact crimes, since homicide is not covered in the ICVS questionnaire. In the first analysis, the dependent variable is one-year victimization by contact crimes (robbery, sexual offences, threats and assaults). In a second analysis, the dependent variable is victimization by these crimes with or without involvement of a firearm. In this analysis, five-year victimization rates are used because the one-year victimization figures are too low. Both analyses are carried out using the data of the ICVS 2004/05 encompassing results from 31, mainly Western, countries.

Table 5 shows victimization levels of owners and non-owners of handguns, for contact crimes, broken down by countries with low, average and high ownership rates of handguns and long guns, respectively.

The results in Table 5 show that owners of a handgun are more often a victim of contact crimes than non-owners, especially in countries with low availability of such firearms. For countries with high and average ownership rates, the relationship between ownership of a handgun and victimization by contact crime goes in the expected direction but is not statistically significant. This result suggests that, in countries where gun ownership is rare, those owning a gun may also possess other risk-enhancing characteristics. This hypothesis will be explored in more detail in a multivariate analysis. Ownership of a long gun is apparently not related to victimization by contact crime at the individual level either.

In a second analysis, we have looked at the relationship between gun ownership and victimization by contact crimes with or without firearms, respectively. Table 6 shows results. The results are similar to those regarding victimization by total contact crimes. Individuals owning a handgun tend to be more at risk of being threatened or attacked (with or without a firearm) in countries where gun ownership is not common:

- For contact crimes *not involving a firearm*, the differences are the largest in countries with low ownership levels. There is no significant difference for countries with high ownership levels.
- For *gun-related* contact crimes, countries with average ownership levels, 2.5 per cent of the owners are victimized by contact crimes involving firearms and only 0.3 per cent of the non-owners. The differences in countries with low and high ownership are not statistically significant but go in the same, expected direction.

TABLE 5 *One-year victimization rates for handgun owners and non-owners for contact crimes, differentiating between inhabitants of countries with low, medium and high availability of firearms*

	Contact crimes	
	Non-owner	Owner
Ownership level of handguns[1]		
Low (<1%)	4.6*	11.9
Average (>1%, <5%)	4.9	5.3
High (>5%)	3.5	3.9
Ownership level of long guns[1]		
Low (<5%)	4.3	4.8
Average (>5%, <15%)	4.5	4.7
High (>15%)	4.5	3.7

[1] See Table 2 for the categorization of counties by ownership level.
* Statistically significant difference between owners and non-owners; ChiSq test, $p < 0.05$. Data from the 2004/05 ICVS.

Correlates of victimization at the individual level

Various theoretical models have been developed to explain how the differential vulnerability of individuals to criminal victimization is determined by their lifestyle or 'routine activities' (Hindelang *et al.* 1978; Felson 2002). The ICVS includes information on demographics such as age, gender, town size, marital status, income and education of respondents. Previous multivariate victimological risk analysis using the ICVS data sets has shown that many of these factors have independent effects on victimization by contact crimes (van Kesteren *et al.* 2000). Besides these known risk factors, the ICVS includes a question on the frequency of outdoor activities in the evening. This factor has also been found to be an independent risk factor of victimization by contact crimes (Van Dijk *et al.* 1980). Finally, previous analyses have shown that victimization by property crime is an independent predictor of victimization by contact crime. A possible explanation for the latter finding is that those victimized by property crime are more exposed to victimization because of their proximity to potential offenders.[2] To test whether gun ownership as such is an independent risk factor, multivariate analyses have been conducted including these other known risk factors besides gun ownership. To this end, log-linear analyses were carried out whereby the independent variables were coded in categories against a base (see also van Kesteren *et al.* 2000). The key independent is the variable distinguishing between gun ownership at individual and country levels. For technical reasons, only 26 Western countries were included (22 European countries plus the United States, Canada, Australia and New Zealand).[3] The dependent variable was the five-year victimization rate.[4] Table 7 shows the results.

The multivariate analysis confirms the known independent risk factors for victimization by contact crime such as young age, being single, living in a big city and an outgoing lifestyle. Being female enhances exposure because of higher victimization by sexual violence. Low education and/or income are risk-reducing factors, probably because they

TABLE 6 *Victimization rates for contact crimes (five-year prevalence rates) involving or not involving a firearm by ownership of firearms and ownership levels*

Ownership level of handguns	Owner of a handgun	Victim of a contact crime without a firearm involved	Victim of a contact crime with a firearm involved	N
Low	Yes	23.7*	0.85	118
	No	14.5	0.32	21,359
Average	Yes	18.1*	2.52*	555
	No	15.1	0.29	20,723
High	Yes	12.0	0.44	1,128
	No	12.8	0.27	15,799

Ownership level of handguns (Low (<1%), Average (>1%, <5%), High (>5%)). See Table 2.
* Significant ($p < 0.05$, ChiSq). Data from the 2004/05 ICVS.

[2] A strong risk factor of victimization by any type of crime is self-reported offending (Wittebrood and Nieuwbeerta 1999). This variable is not available in the ICVS data sets.

[3] The data-analysis techniques used here do not allow for missing values. Mexico, Poland, Estonia and Japan had to be removed from the database because one or more variables were missing in their databases. List-wise deletion also removed on average 25 per cent of the respondents from these 26 countries.

[4] Log-linear analysis is the analysis of a multidimensional cross table. The five-year victimization rates are higher than the one-year rates and therefore there are fewer empty cells in the cross table which leads to more stable results.

limit leisure time activities. As expected, victimization by property crime acts as a powerful predictor of victimization by contact crime. Controlling for the effects of these external independents, handgun ownership comes out as an independent predictor of victimization by contact crimes in countries with medium and high levels of gun availability.

Multilevel Results on Individual and Country Levels

A multilevel analysis using the same ICVS 2004/05 data is the final step in our analysis. The data have been subjected to the same list-wise procedure as was done for the log-linear analysis and therefore represent the same population. The difference, however, is that most of the variables were not categorized but interpreted as data at

TABLE 7 *Results of a log-linear analysis with five-year victimization by three contact crimes as dependent and a selection of known risk factors and ownership of handguns and long guns as independents*

	Risk model involving ownership of	
	Long guns	Handguns
Victim of a property crime		
No	Base	Base
Yes	2.17*	2.08*
Age		
Old	Base	Base
Middle-aged	2.18*	2.14*
Young	3.54*	3.44*
Gender		
Female	Base	Base
Male	0.88*	0.87*
Income		
Below average	Base	Base
Above average	0.88*	0.88*
Education		
Below average	Base	Base
Above average	1.15*	1.13*
Going out		
Less than once a week	Base	Base
Once a week or more	1.08*	1.07*
Partner		
Yes	Base	Base
No	1.62*	1.65*
City size		
Small	Base	Base
Mid-size/large	1.21*	1.20*
Capital	1.38*	1.38*
Ownership/level	*Long guns*	*Handguns*
No/Low	Base	Base
Yes/Low	1.14	1.06
No/Middle	0.88	0.93
Yes/Middle	0.97	1.41*
No/High	0.93	0.74*
Yes/High	0.77	0.93

* Significant: $p < 0.05$.
Data from the 2004/05 ICVS (26 Western countries).

TABLE 8 *Results of a Multilevel analysis on three contact crimes*

	Model 0		Model 1		Model 2		Model 3		Model 4	
	Parameter	S	Parameter	S	Parameter	S	Parameter	S	Parameter	S
Fixed effects										
Constant	−3.158*	0.086	−3.284*	0.083	−3.549*	0.083	−6.254*	0.683	−6.239*	0.683
Victim of theft			0.886	0.060	0.728	0.062	0.726*	0.068	0.707*	0.062
Handgun ownership			0.179	0.134	0.217*	0.135	0.230*	0.136	0.267*	0.136
Long-gun ownership			−0.076	0.085	0.027	0.087	0.021	0.088	0.018	0.116
Individual-level variables										
Gender (base = male)					0.090*	0.050	0.091*	0.050	0.090*	0.050
Partner (base = yes)					0.411*	0.053	0.413*	0.053	0.338*	0.068
Town size (Z-score)					0.109*	0.033	0.107*	0.033	0.106*	0.033
Going out (Z-score)					0.090*	0.032	0.089*	0.032	0.088*	0.032
Age (Z-score)					−0.459	0.028	−0.470	0.028	−0.460	0.028
Education (Z-score)					0.006	0.028	0.006	0.033	0.006	0.028
Income (Z-score)					−0.006	0.033	−0.006	0.033	−0.006	0.033
Country-level variables										
Handgun ownership level							−0.014	0.018	−0.046*	0.027
Long-gun ownership level							0.009	0.009	0.009	0.009
GDPpc (purchasing power in US$)							0.000	0.000	0.000	0.000
Educational level (enrolment)							0.017*	0.005	0.017*	0.005
GINI (income differences)							0.013	0.012	0.013	0.012
Urbanization (percentage living in urban area)							0.005	0.005	0.005	0.005
Interaction of handgun ownership levels with										
Ownership of long guns									−0.043*	0.021
Not living with a partner									0.023*	0.013
Random effects										
Intercept	0.170	0.053	0.154	0.049	0.112	0.037	0.052	0.020	0.056	0.021

* Significant at $p < 0.5$, *t*-test, one-tailed.

the interval level. With the exception of gender, firearm ownership and living with a partner remained dichotomies. All variables have been transformed into z-scores. This means that the average of the variables is set at 0 and the standard deviation at 1.[5] In this final stage of the analysis, the same independents as in the log-linear analysis at the level of individuals were included and some characteristics of countries. The added variables at country level are wealth (GDP per capita), income differences (GINI index) and educational level from the 2005 Human Development Report (UNDP 2005).[6] Also included is the rate of urbanization taken from the UN World Urbanisation Prospects (United Nations 2006).[7] From the ICVS database, we took the

[5] The procedure used for this is the SPSS command Rank/normal.

[6] Data from these sources are not available for England and Wales, Scotland and Northern Ireland separately, but only for the United Kingdom as a whole. Estimates are made for the three parts of the United Kingdom.

[7] Tables with data and their sources are available on request.

handgun and long-gun firearm-ownership levels (percentage of households owning at least one). Since the dependent variable is a dichotomy, not a linear but a log-linear model is fitted on the data. This is done by taking the Logit of the victimization as the dependent variable.[8] The result is that the outcomes of the model for extreme values get near to 0 and 1.

The data were analysed using MlwiN, developed by the University of London (Rasbach *et al.* 2004). The procedure followed involved five models. Results are presented in Table 8. The first is a model with no explanatory variables except a constant. In the second model, two firearm-ownership variables are added, namely ownership of handguns and long guns. Then the other known variables at the individual level are added and then the variables at the country level. In the last stage, all possible interactions between the ownership levels of handguns and long guns are combined with the seven variables at the individual level. Of the 14 possible interactions, only the interactions that are statistically significant will be mentioned. These are added to the final, fifth model.

The results of the multilevel analysis of victimization by contact crimes are presented in Table 7. There are five columns with results, corresponding with the five created models. The column on the right side represents the final model. The parameters in the table are regression coefficients with the Logit of victimization as the dependent variable. In the column next to it, the standard deviations for the parameters in parentheses are given in italics. If the regression parameter is larger than 1.645 times the standard deviation, the parameter is significantly larger than 0 (*t*-test, one-tailed, $p < 0.05$). Since we have concrete hypothesis, use of one-tailed testing is allowed; two-sided testing has as a result that fewer of the parameters will be significant.

Model 0 is the intercept-only model. The random variance of the intercept indicates the overall differences between the 26 countries. Model 1 adds ownership of handguns and ownership of long guns to the model. Ownership of a handgun leads to higher risks for contact crimes, but, in this minimalistic model, not significantly so. Owning a long gun has no effect on victimization. The variance of the intercept showed no change, meaning that ownership of firearm at the individual level does not explain the differences between countries. Model 2 adds known risk variables at the individual level. The largest effects are for those living alone and of young age. Other significant factors in this model are the size of the town and the frequency of going out. Gender, education and income levels show no significant effects here. The effect of handgun ownership is somewhat larger in this model compared to Model 1 and statistically significant. The variance of the intercept is reduced to 0.112, which means that 34 per cent of the differences between countries in levels of contact crimes are explained by differences in composition of the population with respect to the seven used variables.

Model 3 adds six variables at the country level to the model, including the levels of ownership of handguns and long guns. With exception of the educational level, the effects of the variables are not statistically significant. More enrolment in education leads to somewhat more contact crimes. The variance of the intercept is reduced to 0.052, which means that an additional 35 per cent of the variance at the country level is explained, mainly by the educational level. In this model, the effect of *individual* ownership of a handgun on *individual* victimization risk is statistically significant.

[8] The Logit of victimization risk P: (LogitP) = Log (P/(1−P).

Interaction effects

In the fifth and final model, two interaction effects with ownership levels of handguns showed a significant effect:

- People living without a partner are more at risk than people living with a partner, but even more so in counties with higher ownership levels for handguns.
- Owning a long gun is in itself no risk factor, but it diminishes the risk in countries with high ownership levels of handguns.

In the final model, having controlled for any effects of independents at the individual or country level (including firearm-ownership levels), people owning handguns are more at risk of becoming a victim of a contact crime. In those countries where many people own handguns, being single is an extra risk factor (on top of the already high risk anywhere else). But, in these countries, owners of a long gun (but not a handgun) are somewhat less at risk.

Conclusions and Discussion

Using a data set including 50 countries, we have found a statistically significant correlation at the country level between ownership levels of handguns and rates of victimization by gun-related contact crimes, gun-related threats and assaults and homicides, gun-related or otherwise. No correlation was found between handgun ownership levels and levels of contact crimes overall.

At the individual level, owners of handguns are significantly more often victims of contact crimes. When controls are introduced for known risk factors such as age, gender, income, educational level, frequency of going out, living with a partner and size of the town of residence, owning a handgun remains a risk factor for victimization by contact crimes. The result was not altered by entering victimization by property crime, a proxy for a risk-taking lifestyle, as an extra control. A multilevel analysis that involved both individual factors related to victimization and country-level factors confirms the conclusion that owning a handgun brings a higher risk for victimization by contact crime. But, at the same time, high availability of handguns is related to slightly lower risks of victimization by contact crimes in general.

The finding that high availability of guns in a country increases the risk to be victimized by gun-related violence or homicide but slightly less to victimization by violent crime (for the non-owners) generally lends support to the hypothesis that gun availability offers potential offenders the opportunity to be more intimidating in their threats or attacks. Through this effect, high availability raises the stakes of violent crime and exacerbates its medical and mental impact on victims. Our results show that high availability results in slightly lower levels of violence across the board, presumably by de-motivating people to commit such crimes. We found some support for the hypothesis that high availability prevents crime by deterring would-be offenders of less serious contact crimes. The analysis, however, shows that owners themselves are more at risk than non-owners.

Of special interest are our results of the role of gun ownership at the individual level in developed countries, since this issue has rarely been examined empirically before. Gun ownership has been found to be a powerful, independent risk-enhancing factor. This result could be spurious in the sense that gun ownership is closely related to other

risk-enhancing characteristics. Ownership of a gun could be a flag or symptom of other risk-enhancing characteristics. After entering various proxies for a risk-taking lifestyle as controls, the link did not weaken. It cannot be excluded that the inclusion in future studies of other controls such as, for example, minority group status, gang membership or employment in law enforcement might partly explain the established relation between ownership of a gun and victimization. Another consideration is that, in the present study, respondents were asked whether a gun was present in the household, not whether the respondent himself owns a gun and carries it around on a regular basis. In our opinion, such more detailed information on ownership is likely to show stronger relationships with victimization by serious violence.

The relation between ownership and victimization also showed up in the analysis by Altheimer (2008) of an ICVS-based data set from respondents in developing countries only and in the results of a dedicated survey on gun ownership and violence in Venezuela (Gabaldón *et al.* 2011). One explanation is that a gun in the house is risk-enhancing because it can be used against other household members (including partners). This argument has been mentioned in the literature (Killias *et al.* 2001; Small Arms Survey 2004). The second explanation is that ownership and especially the habit of carrying a concealed gun around may generate the 'illusion of invincibility'. This mental state could result in risk-taking or provocative behaviour which enhances victimization risks. Similar counterproductive effects have been observed among users of safety belts in motorcars, the 'security illusion' or 'risk homeostasis theory' (Evans 1986; Wilde 1994). In some countries, those in possession of a gun may share values of a macho or honour culture which further stimulates them to act dangerously. Our results offer, at any rate, no support for the notion that gun ownership performs a *protective* function for the owner.

To conclude, at the community level, high levels of gun ownership seem to have conflicting effects on levels of violence. When conflicts arise in high-gun environments, the stakes of a fight are relatively high. This may deter some would-be attackers and prevent acts of simple violence. In other words, would-be attackers may feel less restrained in low-gun countries such as Great Britain and the Netherlands. At the same time, in high-gun countries, the risks of escalation to more serious and lethal violence are higher. On balance, considerably more serious crimes of violence are committed in such countries. For this reason, the strict gun-reduction policies of many governments seem to be a sensible means to advance the common good.

At the individual level, the statistical facts are unambiguous. Contrary to what has been claimed by proponents of widespread gun ownership in the United States, those households that own guns run higher risks of seeing their members being criminally victimized, either by other household members or by outsiders who are not deterred from attacking. This correlational finding provides no proof that the higher risks are *caused* by ownership of a gun; ownership might also be a proxy for a high-risk lifestyle. But this result certainly sheds serious doubt on the notion of gun ownership as a protective factor.

Where previous studies used data sources from a limited number of countries or even from one single country only, this article is based on victimization data from almost all major industrialized countries. Future studies using international data should, in our view, focus on three different issues:

- First, these studies ought to include larger samples of developing countries. Although much information on the gun–violence link is available from the Small Arms Surveys

on individual countries, there is a lack of quantitative cross-sectional and time-series studies from Africa and Latin America. The repeat of the ICVS in more developing countries would greatly increase the opportunities for such policy-relevant analyses. Fortunately, more victimization surveys are now being conducted in South America, including in Argentina, Brazil, Mexico and Venezuela.

- Second, future studies should seek to make more detailed distinctions between the various types of violence and the circumstances under which they are committed. For this purpose, data from victimization surveys could be supplemented with more detailed police-recorded information on serious crimes of violence.
- Third, our analyses have consistently shown that availability of *long guns* bears no relationship with levels of victimization by any type of crime at either collective or individual levels, since most of these guns are used for hunting. Future studies on the gun–violence link should, in our view, be restricted to data on handgun ownership and perhaps assault rifles at the individual level. The use of data on firearm ownership including long guns could result into false negatives regarding the gun–violence link.

Acknowledgements

I am indebted to Jan Van Dijk for his long-term contribution to the execution of the ICVS and for his supervision of the preparation of this article.

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Additional Tables (Available from the Author on Request)

Appendix 1: table with ownership rates of firearms, homicide, homicide with a firearm and ratio of homicides, committed with a firearm in 14 industrialized countries. Data from the 10th UN survey (UNODC 2009).

Appendix 2: External data at country level as used for the multilevel analysis. Sources: United Nations.[a]

Appendix 3 Homicide data at country level from the 10th UN survey and others.